CLAIMS

We claim:

1. A method for performing atomic layer deposition, the method comprising:

providing a multi-wafer sequential deposition module having a plurality of wafer stations;

inserting a plurality of wafers within the multi-wafer sequential deposition module;

rotating the plurality of wafers in a sequential fashion among the plurality of wafer stations;

depositing at least one monolayer on each of the plurality of wafers at each of the plurality of wafer stations; and

rotating a plurality of process gases in a sequential fashion among the plurality of wafer stations to complete the atomic layer deposition on each of the plurality of wafers.

2. The method of Claim 1, further comprising inserting at least one additional wafer into the multi-wafer sequential deposition module and removing at least one of the plurality of wafers when a desired deposition layer thickness is obtained.

3. The method of Claim 1, wherein the rotating of the plurality of process gases occurs by directing each of the plurality of process gases directly from one station to the next station among the plurality of wafer stations.

4. The method of Claim 1, wherein the rotating of the plurality of process gases is performed by a rotary ball valve.

5. The method of Claim 1, wherein the plurality of process gases includes a first process gas introduced at a first station of the plurality of wafer stations and a second process gas introduced at a second station of the plurality of wafer stations, wherein the first process gas and the second process gas are sequentially rotated among the plurality of wafer stations to complete a deposition layer for each of the plurality of wafers.

6. The method of Claim 1, further comprising supplying an inert gas to each of the plurality of wafer stations that are not receiving one of the plurality of process gases.

7. The method of Claim 1, further comprising flowing an inert gas between each of the plurality of wafer stations to isolate each of the plurality of process gases and prevent undesired deposition.

8. The method of Claim 1, further comprising performing conventional chemical vapor deposition within the multi-wafer sequential deposition module concurrently with atomic layer deposition.

9. The method of Claim 1, wherein the atomic layer deposition film is formed using at least one of a reactant gas, an ion stream, or a radical stream.

10. The method of Claim 1, wherein at least one of the plurality of wafers is biased by delivering electrical power to a substrate holder of the corresponding wafer station.

11. The method of Claim 1, wherein a spacing between a showerhead of at least one of the plurality of wafer stations and at least one of the plurality of wafers is set for plasma processing.

12. A semiconductor device having a deposition layer formed according to the method of Claim 1.

13. A method for performing atomic layer deposition in a multi-wafer sequential deposition module having a plurality of wafer stations, the method comprising:

moving a plurality of wafers in a sequential order among the plurality of wafer stations;

introducing a first process gas at a first station of the plurality of wafer stations;

introducing a second process gas at a second station of the plurality of wafer stations; and

rotating the first process gas and the second process gas sequentially to at least the first wafer station and the second wafer station of the plurality of wafer stations to form an atomic layer deposition film on corresponding wafers from the

plurality of wafers positioned at the first wafer station and the second wafer station.

14. The method of Claim 13, wherein the plurality of wafers receive a portion of a total deposition thickness at each of the plurality of wafer stations that receive the first process gas and the second process gas.

15. The method of Claim 13, wherein the first process gas and the second process gas are not diverted from the plurality of wafer stations as the atomic layer deposition film is formed.

16. The method of Claim 13, wherein the rotating of the first process gas and the second process gas is performed by a rotary ball valve.

17. The method of Claim 13, further comprising flowing an inert gas to each of the plurality of wafer stations that are not receiving the first process gas or the second process gas.

18. The method of Claim 13, further comprising flowing an inert gas between each of the plurality of wafer stations.

19. The method of Claim 13, further comprising performing a conventional chemical vapor deposition process within the multi-wafer sequential deposition module for at least one of the plurality of wafer stations.

20. The method of Claim 13, wherein the atomic layer deposition film is formed using at least one of a reactant gas, an ion stream, or a radical stream.

21. The method of Claim 13, wherein at least one of the plurality of wafers is biased by delivering electrical power to the corresponding wafer station.

22. A semiconductor device having an atomic layer deposition film formed according to the method of Claim 13.

23. A method for applying a deposition layer on a semiconductor substrate, the method comprising:

providing a multi-wafer sequential deposition module having a plurality of wafer stations and a plurality of showerheads;

inserting a plurality of wafers within the multi-wafer sequential deposition module;

flowing one or more types of gas compositions through one or more of the plurality of showerheads; and

rotating the plurality of wafers in a sequential, continuous fashion under the plurality of showerheads until a desired thickness of the deposition layer is formed.

24. The method of Claim 23, wherein the deposition layer is formed by either an atomic layer deposition process or a chemical vapor deposition process.

25. The method of Claim 23, wherein at least one of the plurality of showerheads has a triangular, a delta, or a linear shape.

26. The method of Claim 23, wherein the deposition layer is formed using at least one of a reactant gas, an ion stream, or a radical stream dispensed by at least one of the plurality of showerheads.

27. The method of Claim 23, further comprising providing an inert gas curtain between each of the plurality of showerheads.

28. The method of Claim 23, wherein at least one of the plurality of showerheads is electrically powered to provide a plasma environment.

29. The method of Claim 23, wherein at least one of the plurality of wafers is biased by delivering electrical power to a substrate holder of the corresponding wafer station.

30. The method of Claim 29, wherein the film properties of the deposition layer formed on the wafer is modified due to plasma energy generated by the electrical power.

31. The method of Claim 23, wherein a spacing between at least one of the plurality of showerheads and at least one of the plurality of wafers is set for plasma processing.

32. A semiconductor device having a deposition layer formed according to the method of Claim 23.